CLAIMS

1. A method of aligning the polarization axes of fiber ends of two optical polarization maintaining fibers with each other, the method comprising the successive steps of:

- placing the fiber ends at each other with longitudinal axes of the fiber ends aligned with each other,
- rotating the fiber ends in repeated angular steps around the longitudinal axes of the fiber ends to take successive angular positions, then for each angular step or angular position:
- - capturing images of the fiber ends as seen in an observation plane,
- - determining from each captured image a light intensity distribution along a line perpendicular to the longitudinal direction of each of the fiber ends, and
- - determining from the determined light intensity distribution a contrast value h for each fiber end,
- this resulting for each fiber end in a light contrast profile of h-values determined as a function of the angular position,
- determining from the light contrast profiles the angular positions of the polarization axes of the fiber ends, and
- rotating the fiber ends in relation to each other by an angle equal to the difference between the angular positions of the polarization axes of the fiber ends,

characterized in that in the substep of capturing images of the fiber ends as seen in an observation plane, the observation plane is taken so that the variation ranges, i.e. the differences between maximum and the minimum values, of the resulting light contrast profiles obtain largest possible values.

2. A method according to claim 1, **characterized in** that when taking the observation plane, focusing is first made on exterior cladding sides of the fiber ends, as seen in an observation direction, so that the observation plane in a reference position passes through the longitudinal axes of the fiber ends, or focusing is first made to obtain sharp images of areas of the images corresponding to central longitudinal areas of the images of the fiber ends, and that then the observation plane is moved a distance forwards or backwards from the reference position.

3. A method according to claim 1, **characterized in** that when taking the observation plane, the following steps are performed:

- first moving the observation plane to a reference position where a sharp focus is obtained of exterior cladding sides of the fiber ends, seen in an observation direction, so that the observation plane in the reference position passes through the longitudinal axes of the fiber ends, or where focusing is such that sharp images of areas of the images corresponding to central longitudinal

areas of the images of the fiber ends are obtained, and

- then from the reference position making an iterative search by moving the observation plane for determining the observation plane in which images of the fibers then are captured.

4. A method according to claim 3, **characterized in** that in making the iterative search,

- first a direction for movement of the observation plane is determined, the direction being either forwards or backwards, and

- then moving the observation plane in repeated steps of a predetermined first length from the reference position and in the determined direction of movement.

5. A method according to claim 4, **characterized in** that in determining the direction for movement, the direction is determined by moving the observation plane forwards and backwards from the reference position by a step of a second predetermined length and determining for each position the variation of the light contrast profile.

6. A method according to claim 3, **characterized in** that before the iterative search the fiber ends are rotated, using the determined angular positions, to reference angular positions in which their slow polarization axes are parallel to the observation direction and then for each step of the iterative search, first the fiber ends are rotated by repeated angular steps about the longitudinal axes to take angular positions within an interval centered around the reference positions, and the light contrast profiles are determined for the interval, the search stopped in the case where all the light contrast profiles have a suitable variation.

7. A method according to claim 6, **characterized in** that in determining the variation for the determined light contrast profiles of each fiber end, degrees of deformation are calculated according to $\Delta h_i = \sum_{k=i}^{i+p} \left| h_{k+1} - h_k \right|$, $i = 1, 2, \ldots, N-p-1$, where N is the number of angular positions within the interval, $p \leq N-2$ is a predetermined number of checking steps and h_k, $k = 1, 2, \ldots, N$ are the determined light contrast values within the interval,

- stopping the iterative search when all the degrees Δh_i of deformation are within a prescribed range of values, i.e. $h_{c1} \leq \Delta h_i \leq h_{c2}$, where h_{c1} and h_{c2} are predetermined threshold values, for all values of i.

8. A device for aligning the polarization axes of fiber ends of two optical polarization maintaining fibers with each other, the device comprising:

- two retainer means, each one arranged to hold an end of an optical fiber and adapted to displace and rotate the end a full turn about the longitudinal axis of the end,

- control means connected to the two retainer means for controlling them to align the longitudinal axes of ends of optical fibers held by the retainer means and to move the ends into a close

relationship at a splice position and then to rotate the ends,

- a light source for illuminating by parallel light the ends at the splice position from a side of the ends,

- a TV camera having a light sensitive surface and providing video signals,

- a lens assembly having an optical axis for imaging the splice position taken in an observation plane onto the light sensitive surface, the TV camera thereby capturing images of the splice position,

- processing and analysis means connected to the control means and to the TV camera for processing and analyzing video signals received from the TV camera,

- the control means adapted to control the retainer means to rotate the fiber end in repeated angular steps around the longitudinal axis of the fiber end to take successive angular positions, and then for each angular position to control the processing and analyzing means to determine from the image captured in each angular position a light intensity distribution along a line perpendicular to the longitudinal direction of the fiber end and to determine from the determined light intensity distribution a contrast value h, this resulting for each fiber end in a light contrast profile of h-values determined as a function of the angular position,

- the control means further adapted to control the processing and analyzing means to determine from the determined light contrast profiles the angular positions of the principal polarization axes of the fiber ends, and

- the control means further adapted to control the retainer means to rotate the fibers ends in relation to each other by an angle equal to the difference between the determined angular positions of the principals axes of the fiber ends,

characterized in that the control means are arranged to control the retainer means to move the fiber ends so to make the observation plane take a position so that the variation ranges of the determined light contrast profiles obtain largest possible values.

9. A device according to claim 8, **characterized in** that the processing and analyzing means comprise:

- calculating means for calculating the variation ranges as the differences between maximum and minimum values of the determined light contrast profiles,

- comparing means connected to the calculating means for comparing the variation ranges to a prescribed value, and

- decision means connected to the comparing means for deciding if the observation is to be moved to a new position.